What is claimed is:

1. A backside illuminated CMOS image sensor device, comprising:

a substrate having a pixel array on a front surface of the substrate;

a dielectric layer disposed on a back surface of the substrate to cover a backside of the pixel array;

a buffer oxide layer disposed on the dielectric layer, wherein the buffer oxide layer has a plurality of concave surfaces positioned to respectively align with each photodiode in the pixel array;

a grid layer disposed on the dielectric layer and having a plurality of openings to respectively expose the concave surfaces of the buffer oxide layer;

a plurality of embedded micro-lenses respectively disposed on the concave surfaces of the buffer oxide layer; and

a plurality of color filter sheets respectively disposed on each of the embedded micro-lenses, wherein a refractive index of the micro-lenses is smaller than a refractive index of the buffer oxide layer.

2. The backside illuminated CMOS image sensor of claim 1, wherein the dielectric layer is made from a dielectric material having a dielectric constant greater than or equal to silicon oxide.

3. The backside illuminated CMOS image sensor of claim 1, wherein the dielectric layer is made from silicon oxide or silicon nitride.

4. The backside illuminated CMOS image sensor of claim 1,

wherein the refractive index of the buffer oxide layer is smaller than a refractive index of the dielectric layer.

5. The backside illuminated CMOS image sensor of claim 1,

wherein a refractive index of the dielectric layer is smaller than a refractive index of the substrate.

6. The backside illuminated CMOS image sensor of claim 1, wherein a focus length of the micro-lenses is equal to a distance from the micro-lenses to the photodiodes.

7. The backside illuminated CMOS image sensor of claim 1, wherein a refractive index of the color filter sheets is smaller than the refractive index of the micro-lenses.

8. The backside illuminated CMOS image sensor of claim 1, wherein the grid layer is made from silicon oxide or metal.

9. The backside illuminated CMOS image sensor of claim 8, wherein the metal is Al, Cu, Cr, or an alloy of Cu.

10. A method of manufacturing a backside illuminated CMOS image sensor device, the method comprising:

forming a dielectric layer on a back surface of a substrate, wherein the substrate has a pixel array formed on a front surface of the substrate;

forming a buffer oxide layer on the dielectric layer;

etching the buffer oxide layer to form a plurality of concave surfaces positioned to respectively align with each photodiode in the pixel array;

forming a plurality of micro-lenses respectively disposed on the concave surfaces of the buffer oxide layer;

forming a grid layer on the buffer oxide layer and with a plurality of openings exposing each of the micro-lenses; and

forming a plurality of color filter sheets respectively in the openings, wherein a refractive index of the micro-lenses is smaller than a refractive index of the buffer oxide layer, for avoiding total reflection of incident light.

11. The method of claim 10, wherein the dielectric layer is made from a dielectric material having a dielectric constant greater than or equal to silicon oxide.

12. The method of claim 10, wherein the grid layer is made from silicon oxide or metal.

13. The method of claim 10, wherein a focus length of the micro-lenses is substantially equal to the distance from the micro-lenses to the photodiodes.

14. A method of manufacturing a backside illuminated CMOS image sensor device, the method comprising:

forming a dielectric layer on a back surface of a substrate, wherein the substrate has a pixel array formed on a front surface of the substrate;

forming a buffer oxide layer on the dielectric layer;

forming a grid layer on the buffer oxide layer and with a plurality of openings positioned to respectively align with each photodiode in the pixel array and continuously etching the exposed buffer oxide layer to form concave surfaces respectively at the bottoms of the openings;

forming a plurality of micro-lenses respectively on the concave surfaces of the buffer oxide layer; and

forming a plurality of color filter sheets respectively in the openings of the grid layer, wherein a refractive index of the micro-lenses is smaller than a refractive index of the buffer oxide layer, for avoiding total reflection of incident light.

15. The method of claim 14, wherein the dielectric layer is made from a dielectric material having a dielectric constant greater than or equal to silicon oxide.

16. The method of claim 14, wherein the grid layer is made from silicon oxide or metal.

17. The method of claim 14, wherein a focus length of the micro-lenses is substantially equal to the distance from the micro-lenses to the photodiodes.

* * * * *